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THE EFFECT OF SELENIUM WITH DIFFERENT LEVELS OF ORGANIC MATTER ADDITION ON DRY MATTER YIELD AND CONTENT AND UPTAKE OF SELENIUM BY LOBIA (*VIGNA UNGUICULAT* L.)

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ABSTRACT

The interaction of applied selenium with organic matter fertilization in lobia (*Vigna unguiculata*) was evaluated in pot experiment. Selenium application at different levels (0-10ppm) significantly decreased in fresh and dry matter yield. However, selenium application increased its content and uptake in plants. Application of organic matter showed favourable effect on fresh and dry matter yield. Application of organic matter reduced content and uptake of selenium showing antagonistic relationship.

Key words : Lobia, Selenium, Organic matter, Antagonism.

INTRODUCTION

Muzaffarnagar district of western U.P. and nearby areas are the major sugarcane growing belt this and majority of farmers of this district are marginal having less than 2 acres of land. Besides, crop production, milk production is the main source of income of these farmers. They use sugarcane top (locally known as agola) as cattle feed. Nutritive value of chopped sugarcane stalk (CSS) is not enough to satisfy energy requirement (Kawashima *et al*., 2001). Nutritive value such as metabolizable energy of sugarcane stalk has not been well elucidated. The CSS can be used as roughage for feeding cattle in the dry season with proper supplementation of protein and energy. Lobia which is generally grown as interculture crop in sugarcane is a leguminous fodder rich in protein and can fulfil nutritional requirement of milch animals.

Selenium though a non-essential element for plants is an important element for animals and feed deficient in selenium reported to be causing animal health problem. Investigation on certain diseases such as muscular dystrophy in calves and lambs, exudative diathesis, liver necrosis and infertility in animals, indicate the effectiveness of selenium in preventing these maladies (Hartley and Grant, 1961). Visual symptoms of selenium toxicity have never been observed in plants growing on naturally seleniferous soils in field. However, visual toxicity symptoms have been produced in green house experiments by the addition of selenite, selenite or organic matter to the soil medium. The uptake of selenium depends on forms and concentration of selenium in soil. The effect of soil organic matter on the uptake of selenium by plants is mixed. Organic matter has a large capacity to remove selenium from solution, but the nature of fixation appears

to be different from that of clay. The uptake of selenium by plants is negatively correlated with organic matter content of soil (Ylaranta, 1983 b), but clover and other pasture species grown in peat soil contains more selenium as compared to that grown in mineral soil (Davis and Watkinson, 1966 b). However, nothing could be predicted for a cover crop used as a fodder crop like lobia. Keeping in view the different aspect mentioned above a pot culture experiment was carried out.

MATERIALS AND METHODS

In the present study in order to suggest remedial measure foe selenium deficiency/ toxicity a pot culture experiment was carried out at Department of Ag. Chemistry and Soil Science, R.K.(P.G.) College, Shamli. A brief description of climate and experimental soil along with analytical methods are describes here.

The climate of experimental site is hot and dry. The mean annual rainfall is around 80 cm. In winters sometimes fog and frost are experienced. Whereas, summers are characterised by fierce and scorching heat. Soils are basic in reaction usually light textured and highly productive.

Pots of 10'' diameter and 10'' height size with a drainage hole at the bottom were used. Lobia (*Vigna unguiculata*) variety UPC-5287 was grown. Well decomposed F.Y.M. collected from dairy farm was used as source of organic matter and AR grade sodium selenite as source of selenium. The surface soil (0- 15cm.) in bulk was collected from a field, which was under cultivation of sugarcane (ratoon) during the previous season and left fellow after harvesting of ratoon. The soil was air dried and processed by passing through 2mm. sieve and filled it into the pots. The soil was analysed for various physical and chemical properties for characterization of soil.

Important physico-chemical characteristics of the soil:

1. Texture class	Sandy loam
2. Mechanical analysis	Sand (60%) silt (20%)
3. pH(1:2.5 water)	7.8
4. EC	$3dsm^{-1}$
5. Organic carbon(%)	0.52
6. Calcium carbonate(%)	0.9
7. Total nutrients	
Nitrogen (%)	0.058
Phosphorus (%)	0.036
Selenium (ppm)	0.33
8. Available nutrients	
Nitrogen (ppm)	110.0
Selenium (ppm)	0.067

A pot experiment consisting of four levels of selenium and four levels of organic matter was conducted as per details given below :

Treatments

(a) Levels of selenium (ppm)	Symbol
Control	Se_0
2	Se_1
5	Se_2
10	Se_3
(b) Levels of organic matter (%)	Symbol
Control	Om_0
0.62	Om_1
1.24	Om_2
2.48	Om_3
Experimental design	R B D
Replications	Three
Total number of pots	48

Table 1 : Effect of selenium and organic matter levels on fresh and dry weight (g/pot) of lobia plants at 50 days after sowing.

Selenium levels (ppm)	Organic matter levels (%)									
	Fresh weight					Dry weight				
	Om_0	Om_1	Om_2	Om_3	Mean	Om_0	Om_1	Om_2	Om_3	Mean
Se_0	147.49	161.21	180.53	198.82	172.01	51.62	56.42	63.18	69.59	60.20
Se_1	147.47	161.11	180.01	198.78	171.84	51.61	56.39	63.00	69.57	60.14
Se_2	138.27	151.14	169.25	186.40	161.26	48.39	52.89	59.24	65.23	56.44
Se_3	107.22	177.19	131.23	144.52	125.04	37.53	41.02	47.16	50.59	44.08
Mean	135.11	147.66	165.25	182.13	-	47.28	51.68	58.14	63.74	-

C.D. (5%)				
Se levels	0.006		0.007	
Om levels		0.006	0.007	
Se × Om levels		0.012	0.015	

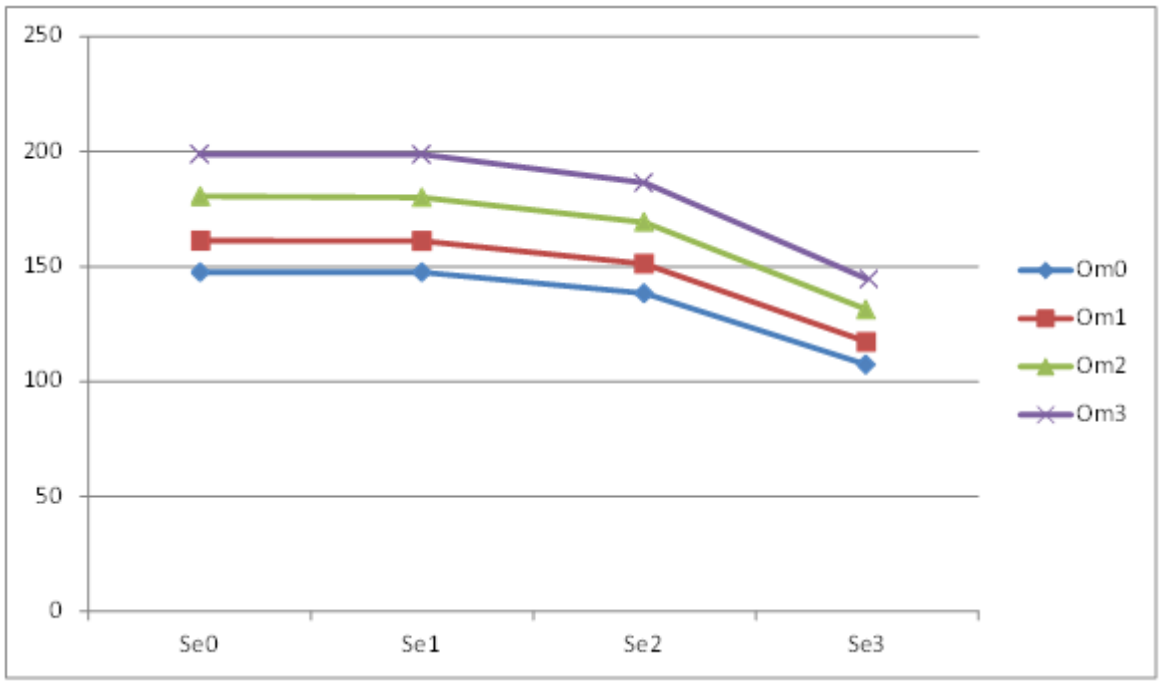

Fig. 1a : Effect of selenium and organic matter levels on fresh weight (g/pot) of lobia plants at 50 days after sowing.

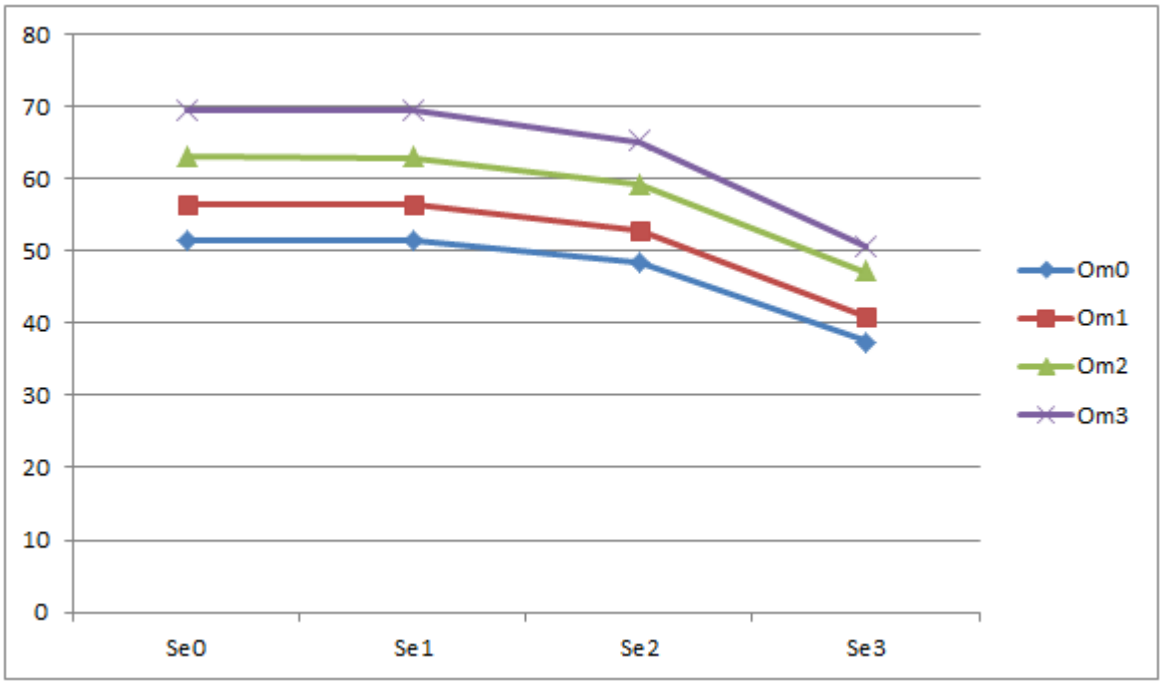

Fig. 1b : Effect of selenium and organic matter levels on dry weight (g/pot) of lobia plants at 50 days after sowing.

The earthen pots of similar size and shape were selected, cleaned and lined with polythene sheets. The processed 5 kg soil was filled in each pot. Recommended doses of N, P, K were added through urea, superphosphate and murate of potash respectively. Soil in each pot was pulverized at appropriate moisture and the required amount of chemicals for the supply of selenium and well decomposed F.Y.M. were added for the supply of selenium and organic matter. They were mixed well with the soil.

Five seeds of lobia var. UPC 5287 were shown on March 5, 2005. The equal amount of double distilled water was applied to each pot. Seedlings appeared emerging out on fifth day after sowing. After one week of germination thinning was done leaving two plants per pot. The plants were irrigated with equal amount of double distilled water as and required. The crop was harvested 50 days after sowing. Immediately after harvest fresh weight of plants from different pots were recorded. The

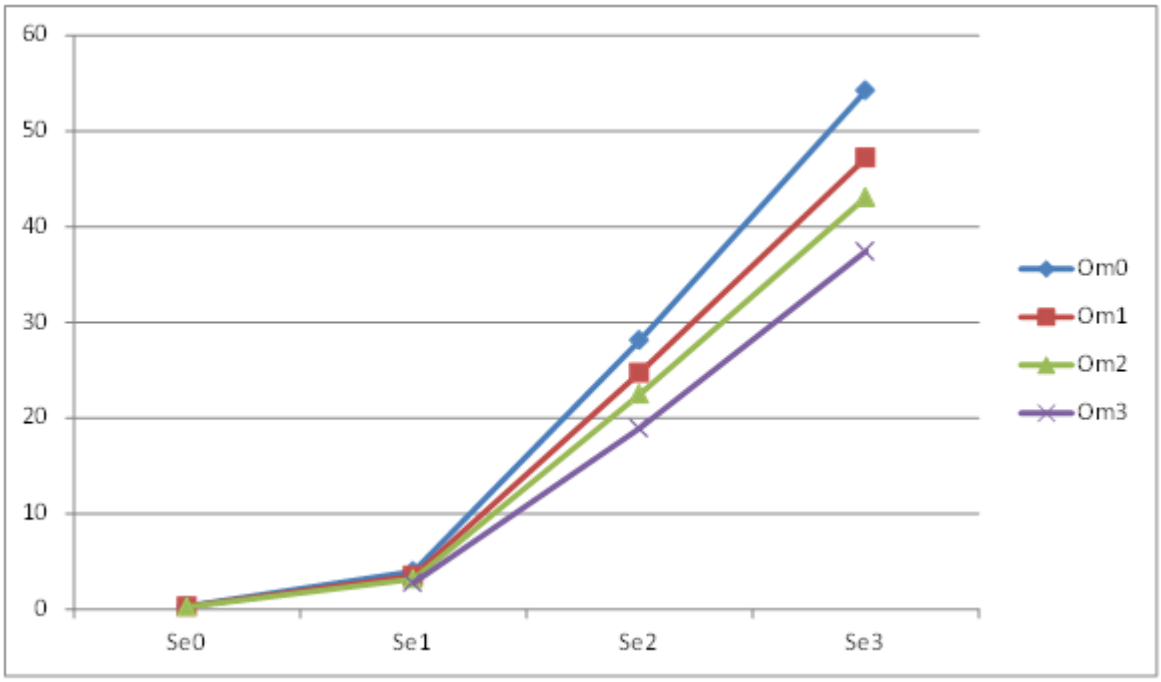

Fig. 2a : Effect of selenium and organic matter levels on selenium content (ppm) in lobia plants at 50 days after sowing.

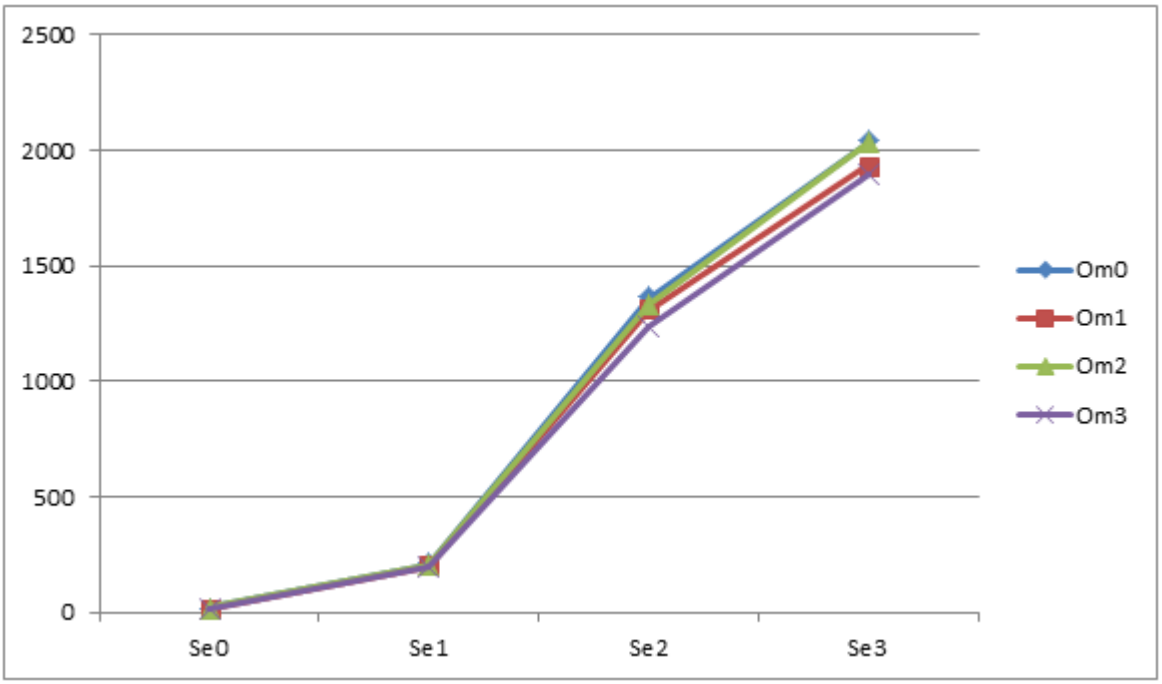

Fig. 2b : Effect of selenium and organic matter levels on selenium uptake (ìg/pot) in lobia plants at 50 days after sowing.

plant samples were left in air for partial drying and then dried in hot air oven at 60^{0}C for 24 hrs. The dry weight of plant from each pot was recorded separately. The dried plant samples were grinded in micro stainless steel grinder and stored in wide mouth stoppered bottles. The ground plant material were analysed for selenium following Cummins *et al*. (1964) method. The uptake of selenium was worked out by multiplying its content value with corresponding dry matter yield.

RESULTS AND DISCUSSION

The data on the effect of selenium in relation to organic matter on fresh weight and dry weight of lobia after 50 days of sowing along its statistical interpretation are presented in table 1 and graph 1a and 1b. A study of table 1 and graphs revealed that increasing levels of selenium decreased the fresh weight of lobia significantly. Application of selenium at 5 and 10ppm levels decreased the fresh yield by 6.25 and 27.31% as compared with

Table 2 : Effect of selenium and organic matter levels on selenium content (ppm) and selenium uptake (µg/pot) in lobia (*Vigna unguiculata*) at 50 days after sowing.

Selenium levels (ppm)	Organic matter levels (%)									
	Selenium content (ppm)					Selenium uptake (µg/pot)				
	Om_0	Om_1	Om_2	Om_3	mean	Om_0	Om_1	Om_2	Om_3	Mean
Se_0	0.35	0.30	0.28	0.23	0.29	17.91	16.80	17.69	16.21	17.15
Se_1	3.98	3.52	3.19	2.79	3.37	206.28	198.49	201.16	194.58	200.13
Se_2	28.13	24.75	22.50	18.96	23.58	1361.21	1309.03	11332.90	1236.95	1310.02
Se_3	54.25	47.21	43.09	37.47	45.50	2035.88	1936.43	2032.45	1895.75	1975.13
Mean	21.68	18.95	17.27	14.87	-	905.32	865.19	896.05	835.87	-

C.D.at (5%)		
Se levels	0.198	0.489
Om levels	0.198	0.489
Se × Om levels	0.396	0.978

treatment where no selenium was applied. Application of organic matter to soil enhanced the fresh yield of lobia significantly. Addition of 0.62, 1.24 and 2.48% organic matter resulted in an increase of 9.3, 22.4 and 34.8% in the fresh yield of lobia. The interaction of selenium and organic matter exhibited a significant effect on fresh yield of lobia. Addition of organic matter to the soil with different doses of selenium increased the fresh yield of lobia compared with the fresh yield obtained with selenium application alone. Application of organic matter alone at its all levels was found superior for fresh yield production than its use in combination of selenium levels similar trend was obtained in dry weight. The data regarding effect of selenium and organic matter on its content and uptake in lobia are presented in table 2. Data revealed that all the levels of selenium were significantly superior to the control in respect of selenium content and uptake. An application of 2ppm selenium gave 11.5 times more selenium content in plants increasing the rate of applied selenium up to 5ppm increased its content in plants by 81 times. It was 156 times more with application of 10ppm selenium over the control. Increasing level of organic matter application decreased selenium content of lobia plants significantly. The interaction effect of organic matter and selenium application was also significant. The application of organic matter with and without selenium application decreased selenium contents of plants the three levels of organic matter also differed significantly among themselves in the ability to reduce the selenium content of plants. Application of selenium to soil increased its uptake the highest being recorded with 10ppm selenium. Application of organic matter to soil decreased the selenium uptake by lobia plants. The maximum selenium uptake was noticed in control. The favourable effect of organic matter on lobia growth in presence of selenium may be because of formation of organometallic complexes which may provide important selenium absorbing site (Levesque, 1974) also reported that organic matter reduces selenium content and uptake. Bisbjerj and Gissel-Nielsen 1969 also found that selenium uptake by red clover, barley and white mustard from selenate added to a muck soil (13% organic matter) was 10 times less than comparing to some mineral soil. It could be concluded that use of organic matter was beneficial in reducing the harmful effect selenium on plant growth of leguminous fodder crop lobia.

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